Title: Uncertainty quantification through reduced modelling of CO_2 injection sites

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The geological storage of CO_2 is proposed as a key technology for the reduction of anthropogenic emissions which drive current climate change. When deployed at sufficient scale, the volume of injected CO_2 will be significant, and predictions of the spread of this buoyant fluid will play an important role in the licensing and public perception of this technology. Currently uncertainty in the spread, and the potential for leakage, of CO_2 presents an added risk and hence cost to proposed geological CO_2 storage projects. This project will develop the tools needed to quantify and characterise the uncertainties in predicting reservoir-scale flow and trapping of CO_2 through the use of ensemble forecasts of a series of new, fast reduced models of CO_2 propagation which will be tested against existing data sets from test injection sites globally.

Geological formations are complex, with heterogeneities ranging from the centimetre to metre scale, which are typically well below the resolution of current seismic imaging methods. Yet, many injection experiments have shown that due to the buoyancy of injected CO_2 these currents flow in narrow layers along pre-existing bedding plans as buoyant gravity currents. Through various projects over the past number of years, we have developed the capability in Cambridge of performing computationally efficient, depth-averaged numerical simulations of buoyant CO_2 gravity currents both in confined and unconfined settings where pressure propagation may play a role (such as at In Salah, Sleipner or Otway), and have developed complementary methodology for incorporating capillary heterogeneity and the impact of heterogeneities on dissolution.

In this project, the prospective student would combine these complementary approaches to simulating the entire injection and post-injection history using a geologically plausible statistical representation of the geological heterogeneities at various injection sites. By running large ensemble forecasts, the impact of heterogeneities on propagation and trapping will be assessed, and a methodology for characterising and presenting the uncertainty, and hence risk, posed by geological heterogeneities will be developed and applied to known CO_2 storage sites.

Applications: Interested applicants will have a quantitative background in Earth Sciences, mathematics, engineering or physical natural sciences. Previous experience with mathematical and/or numerical modelling and geophysical data sets is desirable but not required.

Fixed-term: The funds for this post are available for 3.5 years in the first instance.

Applicants are encouraged to contact Dr. Jerome Neufeld or Professor Mike Bickle (jn271@cam.ac.uk or mb72@esc.cam.ac.uk) regarding the position. More information about our research group can be found at

http://www.damtp.cam.ac.uk/user/jneufeld/index.html

The University and the Department are committed to equality, diversity and inclusion, and encourage applications from all sections of society. The University holds an institutional Athena-SWAN silver award and the Department is a bronze award holder.